

Density Challenge

If it Sinks, You Lose!!!

Background:

Density is the ratio between the mass of an object to the volume of an object. (The amount of matter in an object compared to the amount of space it takes up.) (D) Density = (m) mass ÷ (v) volume

This formula helps to explain why a very massive freight liner can still float on water. The ratio of mass to volume is less than the density of water 1.0 g/ml or 1.0 g/cm³, which allows it to float. Any thing that float has a density of less than 1 g/ml.

Purpose:

In this lab your challenge is to fill a film canister with the most sand and still have it float in the water. The goal is to make the heaviest canister without having it sink. You will get only one attempt at doing this. If it sinks, you lose!! You will need to calculate the amount of sand very carefully.

Materials:

Plastic film canister
Metric ruler

Sand
Forceps

Balance

Scoop or spatula

Procedures:

1. Obtain a film canister and metric ruler. The lid is not considered in the volume.
2. First, calculate the maximum amount of sand that theoretically can be added to the film canister and still allow the film canister to float in water. Remember, in order to float in water, an object's density must be less than 1.0 g/cm³.
3. Use the balance to measure and add the calculated amount of sand to the film canister.
4. Take the sand-filled canister to your instructor. Allow your instructor to weigh the canister.
5. Carefully lower the canister into the water using forceps. If the canister sinks, it is eliminated from the competition. The heaviest floating film canister wins the competition.

Calculations:

Measure the diameter and height of the canister in centimeters. Calculate the volume of the canister using the following formula:

$$V = \pi r^2 h$$

v = volume

$\pi = 3.14$

r = radius (diameter ÷ 2)

h = height

Data:

Diameter of canister = _____

Radius of canister = _____

Height of canister = _____

Volume of canister = _____

Mass of sand needed = _____

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Mass of canister plus sand = _____

Density of canister with sand = _____

Hint:

For the density to equal 1.0 g/ml, the mass of the canister plus the sand must equal the volume of the canister. However, you will want a density of slightly less than 1.0 g/ml so therefore a slightly lighter (less massive) canister.

Brainstorm: (2) Things to consider.

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1)

2)